

SAM results regarding skills needs and gaps in AM



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2nd Workshop for the validation of needs in Additive Manufacturing, 27th January 2021, Online, WP4

Project No. 601217-EPP-1-2018-1-BE-EPPKA2-SSA-B



This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Overview

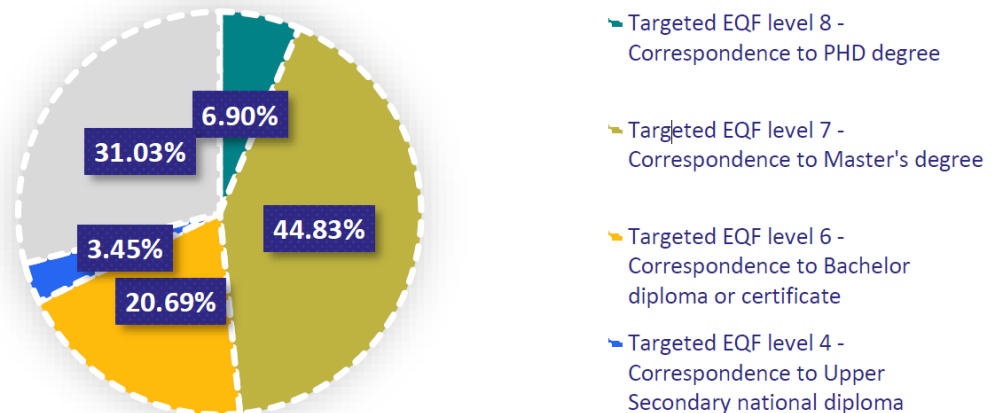
- Background / Source of results
- Formats and levels of training in the market
- Relevance and priorities of workers skills needs
- The profile of the AM worker
- Skills required by professionals & companies
- Training of non-technological professionals
- Skills Shortage
- Skills Activation
- Conclusion and outlook

Skills needs and gaps in AM – asking the experts...

- 3 AM surveys in 2020 to determine the AM skills needs of the market
- Surveys with training centres, workforce and companies
- Determine important trends for sectors, materials and processes
- Identify the required skills for AM and the availability of AM training
- According to the timeframe of a real case scenario (now) and for a short term scenario (in the next 2 years)

Skills needs – Available formats and levels of training?

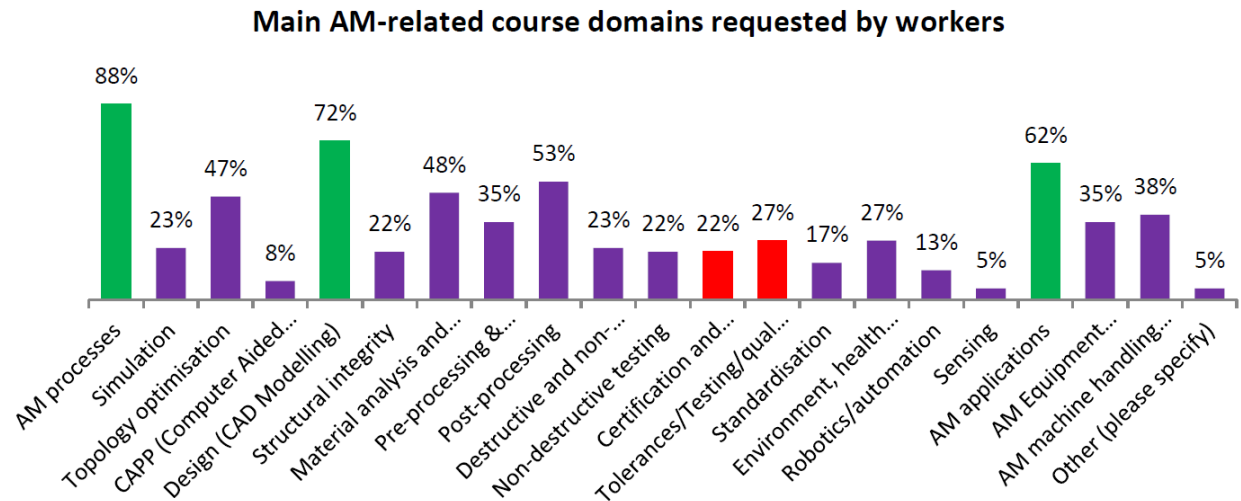
- 96 replies on the survey on AM training (universities, training institutes and other entities)
- Focus on higher qualification levels (Bachelor's or Master's degree)
- AM training in higher student education ✓
- **Needs: AM training for EQF levels 4 and 5**



Skills needs – Available formats and levels of training?

- Most important technological skills for AM workers: AM process (88%), Design (CAD Modelling, 72%), AM applications (62%)
- Similar to top 3 of skills of companies and addressed in training

➤ **Provided AM courses for technological skills are market-orientated**



Workers skills needs – relevance and priorities

- AM industry survey with 138 AM working professionals
- Determination of AM workers' skills needs:
 - Current skills needs (real case scenario, now)
 - Future skills needs (short term scenario, within a period of 2 years)
- the participants voted the most and less important topics for different categories of skills (technological, entrepreneurship, digital, green)

Workers skills needs – relevance and priorities

- current skills needs (real case scenario, now) and
- future skills needs (short term scenario, within a period of 2 years)
- Technological skills:

Technological	MOST	<p>AM processes</p> <ul style="list-style-type: none"> • Materials' analysis and characterization • AM applications • Design 	<p>AM processes</p> <ul style="list-style-type: none"> • AM applications • Materials' analysis and characterization • Design 	<ul style="list-style-type: none"> • Consistency in terms of needs; • In general the relevance of all skills is estimated higher in 2021/2022 than in 2020 • Knowledge and Skills on Standardization loses relevance • Materials' analysis and characterization appears in 2021/2022 as most demanded
	LESS	<ul style="list-style-type: none"> • Numerical modelling • CAPP (Computer Aided Process Planning) for AM • Robotics/Automatiom 	<ul style="list-style-type: none"> • Numerical modelling • CAPP (Computer Aided Process Planning) for AM • Robotics/Automatiom 	

Workers skills needs – relevance and priorities

- current skills needs (real case scenario, now) and
- future skills needs (short term scenario, within a period of 2 years)
- Entrepreneurship skills:

Entrepreneurship	MOST	<ul style="list-style-type: none"> • Learning through experience • Working with others • Motivation and perseverance • Creativity 	<ul style="list-style-type: none"> • Learning through experience • Working with others • Vision • Spotting opportunities 	<ul style="list-style-type: none"> • Motivation is maintained as most demanded Financial and economic literacy and Mobilising others are maintaining in both scenarios as less chosen
	LESS	<ul style="list-style-type: none"> • Ethical and sustainable thinking • Financial and economic literacy • Mobilising others 	<ul style="list-style-type: none"> • Self-awareness and self-efficacy • Financial and economic literacy • Mobilising others 	

Workers skills needs – relevance and priorities

- current skills needs (real case scenario, now) and
- future skills needs (short term scenario, within a period of 2 years)
- Digital skills:

Digital	MOST	<ul style="list-style-type: none"> • Ability to think in 3D • Digital data management (big data, statistics...) • Digital data analysis (Artificial Intelligence, Machine learning...) • Coding/Programming 	<ul style="list-style-type: none"> • Ability to think in 3D • Digital data analysis (Artificial Intelligence, Machine learning...) • Digital data management (big data, statistics...) • Coding/Programming 	<ul style="list-style-type: none"> • There are no changes in terms of relevance in 2020/2021 • Ability to think in 3D has a high importance in both scenarios;
	LESS	<ul style="list-style-type: none"> • Cybersecurity 	<ul style="list-style-type: none"> • Cybersecurity 	

Workers skills needs – relevance and priorities

- current skills needs (real case scenario, now) and
- future skills needs (short term scenario, within a period of 2 years)
- Green skills:

Green	MOST	<ul style="list-style-type: none"> • Circular economy • Life Cycle Analysis (LCA) • Green awareness • Resource efficiency management 	<ul style="list-style-type: none"> • Resource efficiency management • Circular economy • Green resources • Green products 	<ul style="list-style-type: none"> • In 2021-2022 workers seem to be aware that these Green skills become more relevant
	LESS	<ul style="list-style-type: none"> • Green resources • Green products 		

The profile of the AM worker

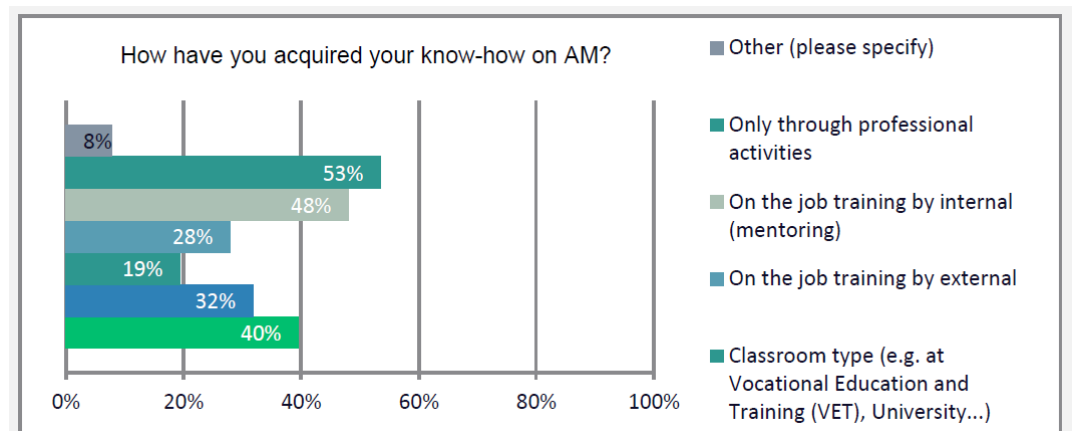
- Predominant **materials knowledge on metals** (30% indicated high and 29% very high expertise) and **polymers** (29% indicated high and 27% very high expertise);
- **Lacking knowledge** regarding **ceramics** (43% have no and 26% low expertise), **biomaterials** (48% have no and 23% low expertise) and **composites** (32% have no and 22% low expertise);
- Most **process expertise** in **Powder Bed Fusion (PBF)**, 20% indicated high and 35% very high expertise) and **Material Extrusion (ME)**, 19% indicated high and 26% very high expertise);

The profile of the AM worker

- Value-chain expertise is predominant regarding **AM Process** (39% indicated high and 34% very high expertise) and **Materials** (37% indicated high and 24% very high expertise);
- **End of life** was one area where **expertise** was generally **low** (15% indicated non and 34 % low expertise), followed by **Modelling/Simulation** (20% indicated non and 28% low expertise);
- 60% of respondents had been working in AM for 1-5 years;

The profile of the AM worker

- 50% of the participants stated they had not received training for their role!
- Most people acquired knowledge through learning by doing (53%) and on job mentoring (48%), followed classroom education (40%) and online courses (32%)



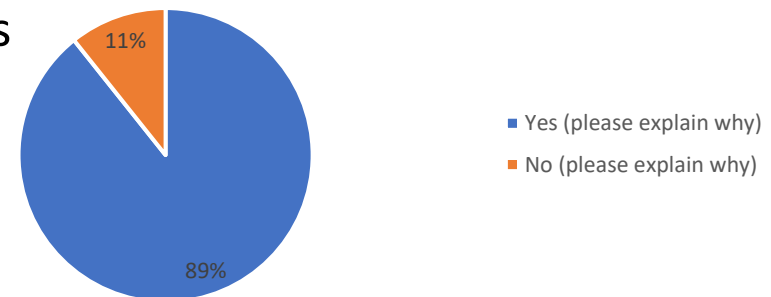
Skills needs – required skills by professionals & companies

- survey with 56 AM companies
- Identification of current and future AM skills needs
- Usage of metals (83%) and polymers (64%), mostly for powder bed fusion (83%) and material extrusion (64%)
- **Technological skills** required by companies
 - Post-processing (30% highly and 37% very highly required)
 - Certification and validation (21% highly and 31% very highly required)
 - Standards (37% highly and 27% very highly required)
 - Costs (43% highly and 23% very highly required)

Skills Shortage

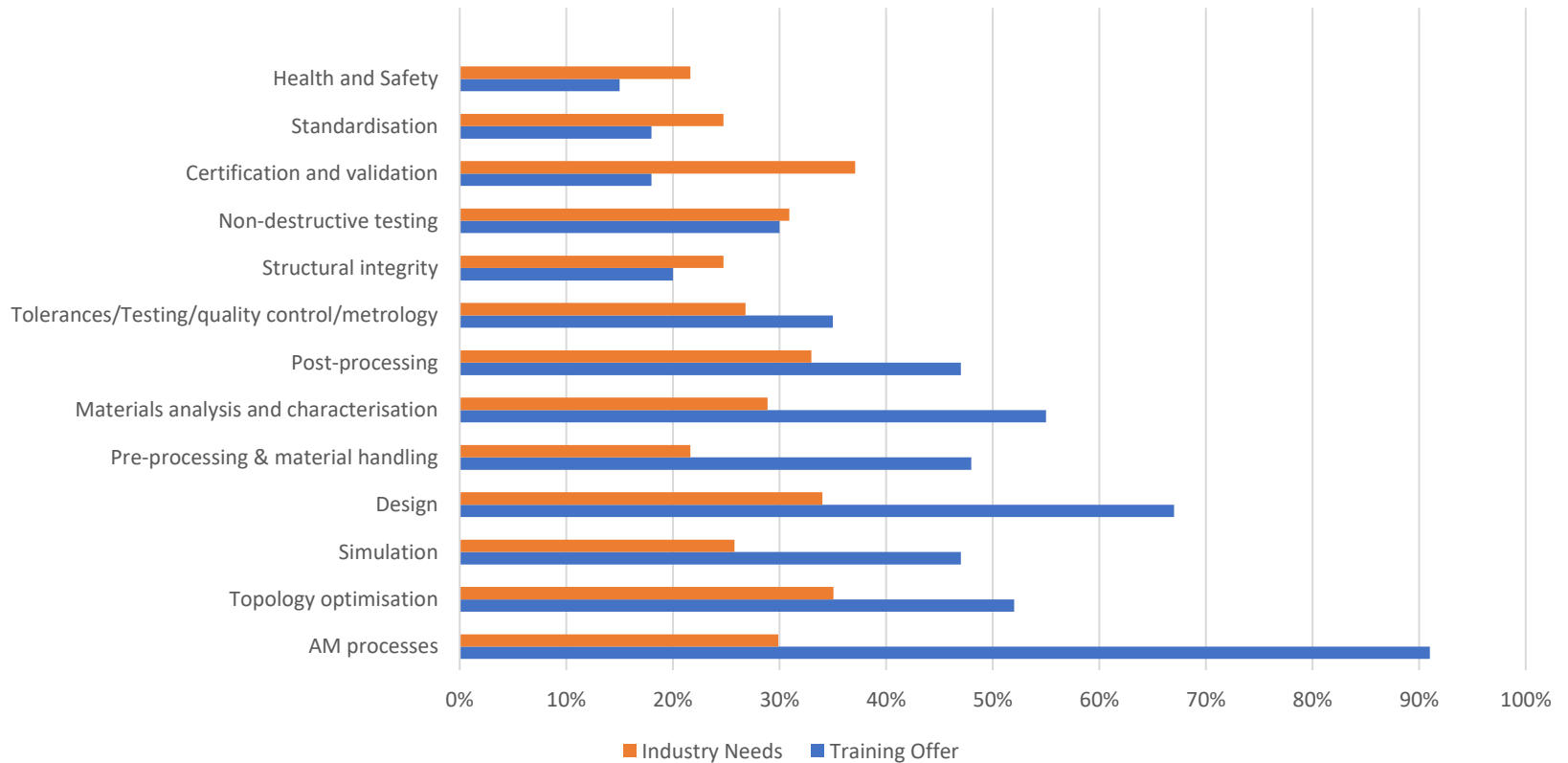
- 89% consider relevant the training of non technological professionals on AM
 - inform about possibilities of AM to increase the acceptance and awareness
 - AM business needs support from cross-functional resources, better inter-departmental collaboration
 - Health professionals and safety officers
 - Commercials
 - Human Resources Technicians

Given the current Covid-19 pandemic, do you consider relevant to train non technological professionals on AM Technology ?



Skills Shortage

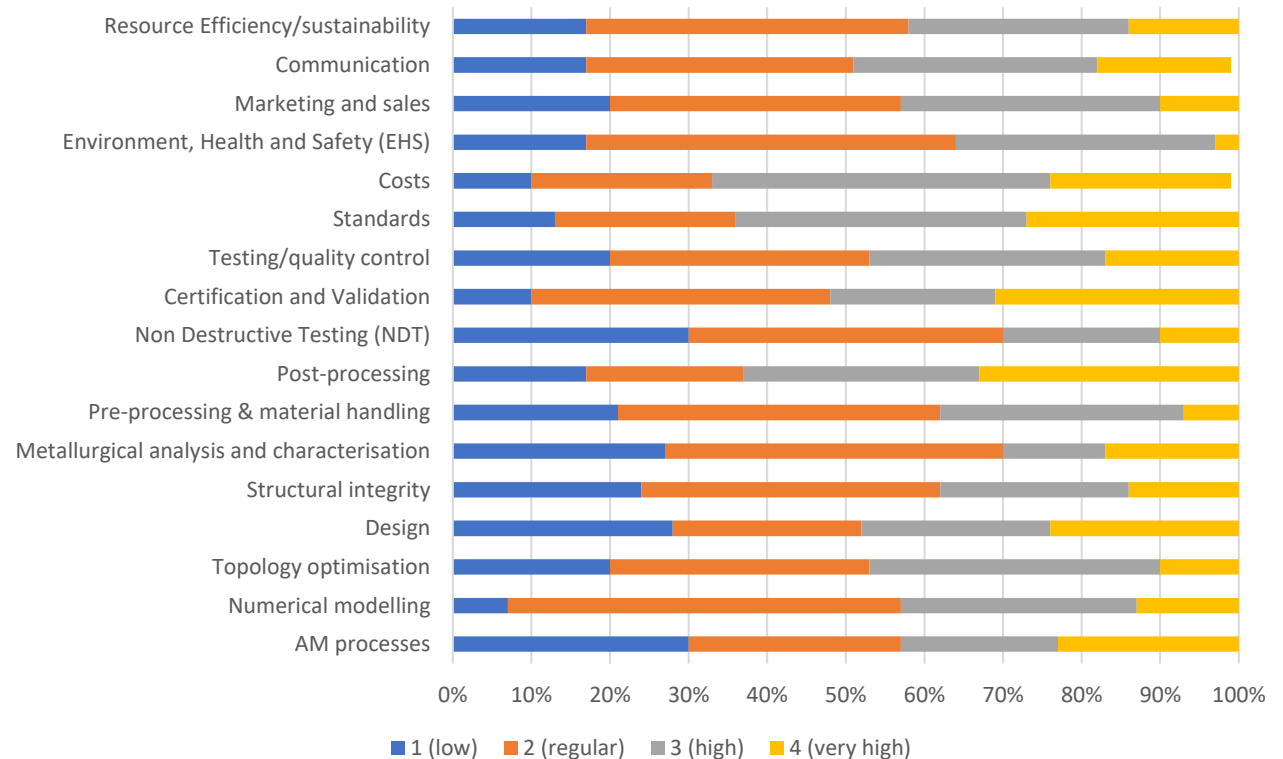
Skills Shortage



Skills Activation

➤ Skills lacks identified by companies

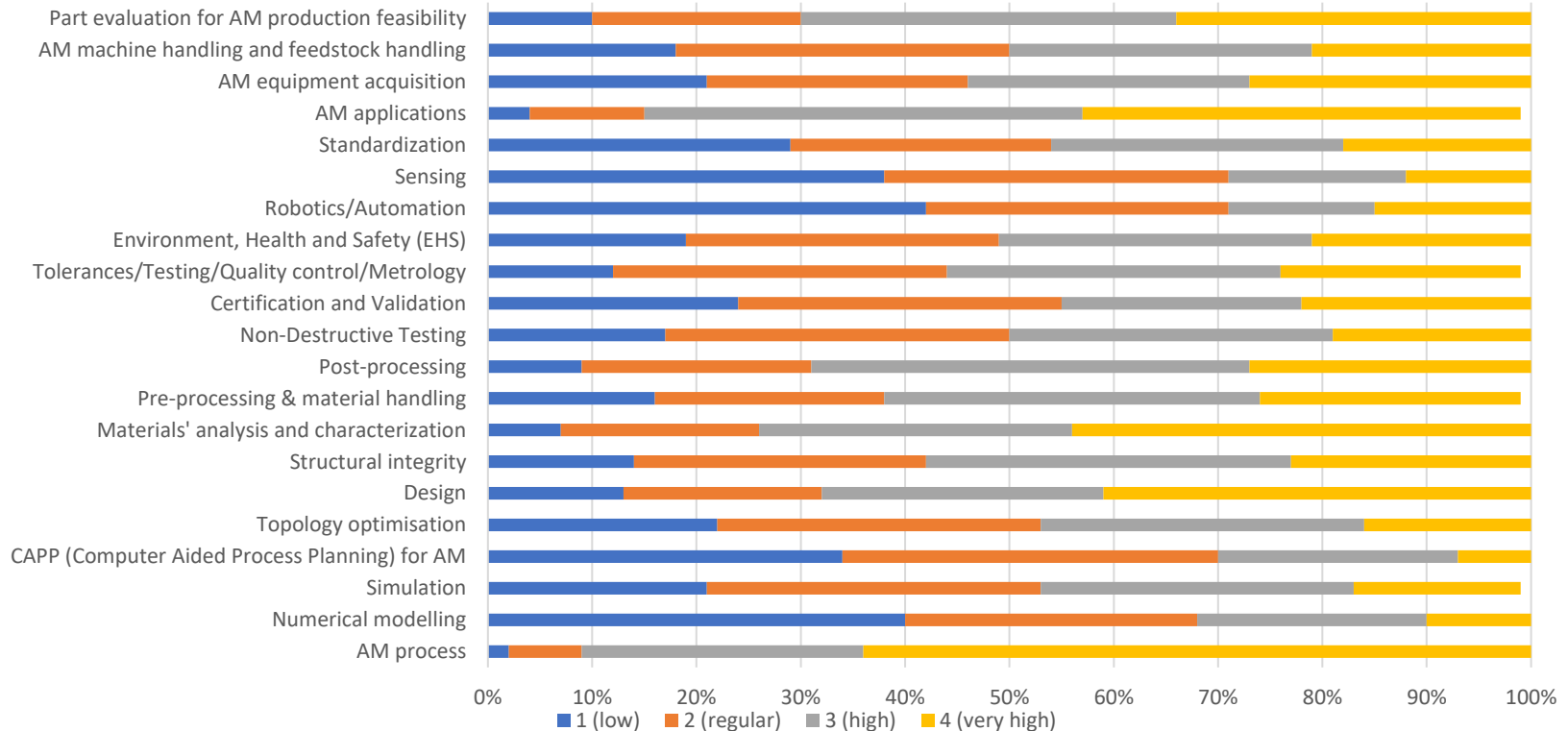
Skills Lack (identified by Companies)



Skills Activation

➤ Skills lacks identified by workers

Skills Relevance at Work (identified by Workers)



Skills needs – Conclusion

- AM training for EQF levels 4 and 5
- Low expertise on end of life and modelling/ simulation
- every second person had no AM training for his/her current task so far
- Required technological skills (companies): post-processing, certification and validation, standards, costs
- Training of non-AM technological professionals

Skills needs - Implication for SAM Project

- results of the surveys will be considered and will influence
 - the SAM project itself
 - The International AM Qualifications and Training System (IAMQS)
 - The definition of new professional profiles
 - The upskilling/reskilling of AM personnel



Future Skills to be addressed by SAM

- AM Designer for Polymers Professional Profile
- AM Certification & Standardization CU
- AM Business CU



Co-funded by the
Erasmus+ Programme
of the European Union

Thank
you

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